REMARKS

Applicants have now had an opportunity to carefully consider the Examiner's Office Action of August 8, 2001. Reexamination and reconsideration of the application, as amended, is respectfully requested.

THE OFFICE ACTION

The disclosure is objected to because of various informalities.

The drawings are objected to because of various informalities.

Claim 13 is objected to because of various informalities.

Claims 22 - 26 are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

Claims 1 - 25 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regards as the invention.

Claims 1 - 8, 10, 11, 17 - 22, 25, and 26 are rejected under 35 U.S.C. 102(b) as being anticipated by Ogura et al.

Claims 9, 12, and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ogura et al. in view of Yamazaki et al.

Claims 14 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ogura et al. in view of Sekiguchi.

Claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ogura et al. in view of Yamada et al.

Claims 23 and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ogura et al. in view of Rajeswaran.

Claims 1, 17, 22, and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tanaka et al. in view of U.S. Pat. No. 5,613,861 to Smith et al.

THE NON-ART OBJECTIONS

The disclosure is objected to because of various

informalities. The disclosure is herewith amended to overcome the objections cited by the Examiner.

The drawings are objected to because of various informalities. Specifically, the Examiner is of the opinion that reference character "10" has been used to designate both chip and laser printbar, and therefore the drawings fail to comply with 37 CFR 1.84(p)(4).

Applicants traverse this position and direct the Examiner to the specification at page 5, third full paragraph for a discussion of the reference character "10" and where it states that:

> FIGURE 2, is a cross-section of a spring contact device **16**. A first portion of spring contact device **16** is silicon or glass substrate **18** which has patterned thereon micro-spring interconnects (also called spring contacts) **20** and **22**. Device **16**, in one embodiment, further includes printbar **10**, having an array of lasers **12**, a first driver chip **24** and a second driver chip **26**. Each of driver chips **24** and **26** may control operation of the lines of one side of the array of lasers **12**. Spring contacts **20** and **22** are designed to provide an electrical connection between driver chips **24, 26** and printbar **10**. The electrical connection between chips **24, 26** and printbar **10** can be obtained by bonding these elements to spring contacts **20** and **22**.

In the illustration of FIGURES 2, 3, 10, and 12, the printbar 10 is shown with only one laser element of an array of lasers 12. This is done for the purposes of not burdening the drawings with a cumbersome showing of the numerous lasers of the device and thereby more clearly presenting the present invention. Consequently the objection should be withdrawn.

The drawings are further objected to under 37 CFR 1.83(a). The Examiner is of the opinion that the physical contact between the light source and the micro-spring interconnects, and the physical contact between the micro-spring interconnects and the driver chips, must be shown for patentably validating the claims.

Applicants traverse the Examiner's opinion that the physical contact must be shown, or those features of the claims canceled. The Examiner is kindly directed to the MPEP § 2164, for a

discussion of the enablement requirement, and where it states, in part, that:

> The purpose of the requirement that the specification describe the invention in such terms that one skilled in the art can make and use the claimed invention is to ensure that the invention is communicated to the interested public in a meaningful way. The information contained in the disclosure of an application must be sufficient to inform those skilled in the relevant art how to both make and use the claimed invention. Detailed procedures for making and using the invention may not be necessary if the description of the invention itself is sufficient to permit those skilled in the art to make and use the invention. A patent claim is invalid if it is not supported by an enabling disclosure."

Applicants assert that the disclosure of this invention complies with the enablement requirement, and that the information contained in the disclosure of the present application is clearly sufficient to inform an artisan skilled in the relevant art how to both make and use the claimed invention. In this case, showing physical contact in the drawings is not necessary, because the description of the invention itself is sufficient, and properly correlates the specification and the drawings, to permit an artisan skilled in the art of micro photolithographic manufacture how to make and use the invention.

Applicants assert that there is proper correlation between the specification and the drawings, as presented in this disclosure. Specifically, the Examiner is directed to the present patent application specification at page 6, third full paragraph for a discussion of how the light source, micro-spring interconnects and driver chips are moved to contact when the device is constructed, and where it states that:

> Implementing spring contacts **20**, **22**, allows printbar **10** to be bilaterally electrically connected to driver chips **24**, **26**. When printbar **10** and driver chips **24,26** are moved to contact under the construction of FIGURE 2, a gap of approximately 20μm gap separates the surfaces of elements **10**, **24** and **26** from the surface of the spring contacts' substrate, element **18**. For a laser printbar and arrangement such as described in FIGURES 1

and 2, the issue of non-uniformity between the many different lasers **12** is a significant problem.

Additionally, on page 8, lines 3-7, of the specification contains a discussion concerning the alignment and fabrication process and where its states that:

> "Further, in this embodiment, the fabrication process depicted in FIGURES 5a-5e and 6a-6e, must ensure that when the integrated device is formed and contacted to a printbar, the sensor and spring contacts are properly aligned in relation to the lasers and the driver chips."

Accordingly, Applicants assert that it would be obvious to an artisan skilled in the art, that a connection is made.

Further, the Examiner is directed to the MPEP § 2164.05 (a), sixth paragraph, and where it states in part "The specification need not disclose what is well-known to those skilled in the art and preferably omits that which is well-known to those skilled and already available to the public."

As such, Applicants assert that the drawings are enabling, properly correlate with the specification, and consequently the objection should be withdrawn.

If, however, the Examiner can provide counter-arguments which would indicate the need to amend the drawings, Applicants respectfully submit sufficient material exists in the specification to support amendments to the figures, such as to FIGURE 2 to extend the lines of the, for example, micro-springs **20** and **22** to be shown in contact with the light bar **10**, and chips **24** and **26**.

It was also noted in the Office Action that the Applicants are required to submit a proposed drawing correction in reply to this present Office Action. Applicants traverse this requirement, for the reasons detailed above, and it is respectfully submitted that the drawings are correct as submitted. However, Applicant will submit formal drawings upon allowance of the application.

Claim 13 is objected to because of various informalities. Claim 13, and page 8, fourth full paragraph, are herewith amended to properly correlate the claims and the specification, in this reply to the present Office Action. Accordingly the objection is overcome and the objection be withdrawn.

THE 35 U.S.C. 112, FIRST PARAGRAPH REJECTIONS

The Examiner rejected claims 22 - 26 under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. The Examiner states that the specification fails to disclose the electrical connection between the sensor, driver chip, and the light source.

With regards to the rejection of claim 22, Applicants direct the Examiner to the present patent application specification, at page 5, lines 11-22, and where it states that:

> FIGURE 2, is a cross-section of a spring contact device **16**. A first portion of spring contact device **16** is silicon or glass substrate **18** which has patterned thereon micro-spring interconnects (also called spring contacts) **20** and **22**. Device **16**, in one embodiment, further includes printbar **10**, having an array of lasers **12**, a first driver chip **24** and a second driver chip **26**. Each of driver chips **24** and **26** may control operation of the lines of one side of the array of lasers **12**. **Spring contacts 20 and 22 are designed to provide an electrical connection between driver chips 24, 26 and printbar 10. The electrical connection between chips 24, 26 and printbar 10 can be obtained by bonding these elements to spring contacts 20 and 22.** It is to be noted that although not shown, printbar **10** and chips **24, 26** may but do not need to be carried on a further-substrate. Driver chips **24, 26** receive image data which are converted into signals delivered to printbar **10**.

Applicants assert that the specification does disclose the electrical connection between the sensor, driver chip, and the light source. Specifically, lines 16-19, on page 5, recite that **"Spring contacts 20 and 22 are designed to provide an electrical connection between driver chips 24, 26 and printbar 10. The**

electrical connection between chips 24, 26 and printbar 10 can be obtained by bonding these elements to spring contacts 20 and 22."

With regards to the rejection of claim 26, Applicants disagree that width, weight, length, and distance measurements are a requirement for the specification to be enabling and the claims to be proper.

Applicants assert that the present invention is fabricated using micro photolithographic processes, and in which a certain amount of non-uniformity is to be expected. The Examiner is directed to the present patent application specification at page 2, lines 16-19, and where it states that:

> designed with as small as 3 μm pitch. At such a pitch, a 4cm-long laser chip would accommodate more than 13,300 individually addressable laser elements, more than necessary for 1,200 dpi printing on a standard 11 inch-long paper, where 13,200 elements are required.

Applicants assert that the specification is enabling because, as stated above, a 4cm-long laser chip would accommodate more than 13,300 individually addressable laser elements having a 3 μm pitch.

Additionally, the Examiner is directed to the MPEP § 2164.05 (a), sixth paragraph, and where it states in part "The specification need not disclose what is well-known to those skilled in the art and preferably omits that which is well-known to those skilled and already available to the public."

As such, Applicants assert that the specification is enabling, and the claims are proper because an artisan skilled in the art of micro photolithographic process would find the present disclosure sufficient to fabricate a 4cm-long laser chip accommodating more than 13,300 individually addressable laser elements with a 3 μm pitch. Consequently the rejection should be withdrawn.

Applicants note that the Examiner rejected claims 22 through 26. However, no separate reasoning is given for rejection of

claims 23, 24, and 25. Applicants have carefully reviewed these claims and assert that they are proper. Therefore, Applicants can only conclude they are rejected based solely on their being dependent on claim 22, and consequently any rejection of these claims is now overcome.

THE 35 U.S.C. 112, SECOND PARAGRAPH REJECTIONS

Claims 1 - 25 are rejected under 35 U.S.C. 112, second paragraph. The Examiner is of the opinion that in claims 1 and 17, it can not be determined what is regarded as the "an elastic material that is initially fixed to a surface on the substrate." The Examiner is directed to the present patent application specification at page 9, fourth full paragraph, for a discussion regarding the composition and fabrication of the elastic material and where it states that:

> In one preferred embodiment, metal patterns **54a-n**, **56**, and **58** are made of an extremely elastic material, such as a chrome-molybdenum alloy or a nickel-zirconium alloy. Depositing of the metal patterns **54a-n**, **56**, and **58** may be achieved by many methods including electron-beam deposition, thermal evaporation, chemical vapor deposition, sputter deposition or other methods.

It is to be appreciated that the elastic material is a chrome-molybdenum alloy or a nickel-zirconium alloy of which the metal patterns may be formed by many methods including, electron-beam deposition, thermal evaporation, chemical vapor deposition, sputter deposition or other methods.

The Examiner further states that the phrase "initially fixed" is not defined in the specification. The Examiner is directed to the present patent application at page 3, third full paragraph, for a discussion of the term initially fixed, and where it states that:

> Integrated on the substrate are a plurality of micro-spring interconnects, where the micro-spring interconnects are formed of an elastic material that is initially fixed to a surface on the substrate. Upon

release of a sacrificial layer a free portion moves out of the plane of the substrate in a self-assembling manner.

To clarify further, Applicants have amended the first full paragraph of page 6, to recite that there is a sacrificial layer removed from the "initially fixed" spring contact, and which now reads:

> Spring contacts **20** and **22** are photolithographically patterned on substrate **18** and designed for electrical connections between devices. An inherent stress gradient in each spring contact causes free portions of the spring contacts to bend up and away from the substrate when a sacrificial layer is selectively removed. An anchor portion remains fixed to the substrate. The spring contact is made of an elastic material and the free portions, which are initially fixed, before the sacrificial layer is selectively removed from the substrate, provides for compliant contacts between devices for an electrical interconnection.

No new matter has been added, as the underlined language essentially repeats language contained on page 3, third full paragraph. As such, the term "initially fixed" is defined in the specification, the specification is enabling, the claims are proper, and that the rejection be withdrawn.

Claims 1, 17, 22, and 26 are rejected under 35 U.S.C. 112, second paragraph, as being incomplete for omitting essential elements. The Examiner is of the opinion that the omitted elements are: a wire or metal layer or some kind of interconnection between the sensor and the micro-spring interconnection; and, supporters for each of the driver chips.

Applicants traverse this position and direct the Examiner to the present patent application specification at page 5, third full paragraph, for a discussion of the interconnection between the sensor and the micro-spring, and where it states that:

> FIGURE 2, is a cross-section of a spring contact device **16**. A first portion of spring contact device **16** is silicon or glass substrate **18** which has patterned thereon micro-spring interconnects (also called spring contacts) **20** and **22**. Device **16**, in one embodiment,

further includes printbar **10**, having an array of lasers **12**, a first driver chip **24** and a second driver chip **26**. Each of driver chips **24** and **26** may control operation of the lines of one side of the array of lasers **12**. Spring contacts **20** and **22** are designed to provide an electrical connection between driver chips **24, 26** and printbar **10**. The electrical connection between chips **24, 26** and printbar **10** can be obtained by bonding these elements to spring contacts **20** and **22**.

It is to be appreciated that an artisan skilled in the art would recognize that as the photolithographic process is performed in the manufacture of the device, supporters for each of the driver chips are indeed formed on the substrate as the photolithographic process progresses. The Examiner is directed to present patent application specification at page 3, third full paragraph, for a discussion of supporters for each of the driver chips, and where it states, in part, that:

> A sensor is formed on the same substrate, and includes an active layer and contacts. The active layer may be substantially transparent to light at infrared wavelengths. The micro-spring interconnects and the sensor are integrated on the substrate and configured using a compatible manufacturing process.

An artisan skilled in the art would recognize that a compatible manufacturing process would require incorporating: a wire or metal layer or some kind of interconnection between the sensor and the micro-spring interconnection; and, supporters for each of the driver chips.

Claims 1, 17, 22, and 26 are rejected under 35 U.S.C. 112, second paragraph, as being incomplete for omitting essential structural cooperative relationships of the elements. The Examiner is of the opinion that the omitted structural cooperative relationships are: a relationship between the sensor and the micro-spring interconnect structure; and a relationship between the length of free portion of the micro-spring interconnect structure (60a-n in Fig. 5e) and a distance between the light source and the sensor. Because, the examiner is not sure how the free portion of the micro-spring interconnect structure will be attached to the light source.

Applicants traverse and kindly direct the Examiner to the present patent application specification, at page 5, lines 11-22, and where it states that:

> FIGURE 2, is a cross-section of a spring contact device **16**. A first portion of spring contact device **16** is silicon or glass substrate **18** which has patterned thereon micro-spring interconnects (also called spring contacts) **20** and **22**. Device **16**, in one embodiment, further includes printbar **10**, having an array of lasers **12**, a first driver chip **24** and a second driver chip **26**. Each of driver chips **24** and **26** may control operation of the lines of one side of the array of lasers **12**. **Spring contacts 20 and 22 are designed to provide an electrical connection between driver chips 24, 26 and printbar 10. The electrical connection between chips 24, 26 and printbar 10 can be obtained by bonding these elements to spring contacts 20 and 22.** It is to be noted that although not shown, printbar **10** and chips **24, 26** may but do not need to be carried on a further-substrate. Driver chips **24, 26** receive image data which are converted into signals delivered to printbar **10**.

Applicants assert that the specification does disclose the structural cooperative relationships between the sensor, driver chip, and the light source. Specifically, lines 16-19, on page 5, recite that "**Spring contacts 20 and 22 are designed to provide an electrical connection between driver chips 24, 26 and printbar 10. The electrical connection between chips 24, 26 and printbar 10 can be obtained by bonding these elements to spring contacts 20 and 22.**" And that, the driver chips receive image data which is then converted into signals delivered to printbar.

Additionally, Applicants direct the Examiner to the present patent application specification at page 6, second full paragraph, for a discussion of the prior art of Photolithographically Patterned Spring Contacts and Methods for Electrically Contacting Devices, commonly assigned and hereby incorporated by reference:

> In one embodiment such contacts are designed in accordance with the teachings of U.S. Patent No. 5,613,861 to Smith et al., entitled, "Photolithographically Patterned Spring Contact"; U.S. Patent No. 5,848,685 to Smith et al., entitled,

"Photolithographically Patterned Spring Contact"; U.S. Patent No. 5,914,218 to Smith et al., entitled, "Method for Forming a Spring Contact"; and U.S. Patent No. 5,944,537 to Smith et al., entitled, "Photolithographically Patterned Spring Contact and Apparatus and Methods for Electrically Contacting Devices", all commonly assigned and hereby incorporated by reference.

Additionally, the Examiner is directed to the MPEP § 2164.05 (a), sixth paragraph, and where it states in part "The specification need not disclose what is well-known to those skilled in the art and preferably omits that which is well-known to those skilled and already available to the public."

As such, Applicants assert that the specification is enabling, the claims are proper, and consequently the rejection should be withdrawn.

The Examiner expressed difficulty with the term "high" in claim 24, and considered it as a relative term, and renders the claim indefinite. The Examiner is of the opinion that the term "high" is not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention.

Applicants disagree and direct the Examiner to the present patent application at page 19, third full paragraph, for a supporting discussion of the term "high", and where it states that:

> The actual control of printbar **10** during printing operation is a more critical step due to a higher speed of signals in high-speed printing (e.g. 673 Mhz when two drivers are employed).

It is to be appreciated that the present invention is used in high-speed printing mechanisms, which are capable of supplying data stream at very high rates. Being exemplary only, in the above example, in which two drivers are employed, a high rate of 673 Mhz is employed. This, therefore, is exemplary of the high frequency bit stream supplied to the driver chip.

As such, the claim is definite, there is support for it in the specification, and that the rejection be withdrawn.

THE CLAIMS PATENTABLY DISTINGUISH OVER THE CITED REFERENCES

The 35 U.S.C. 102(b) Rejections

The Examiner rejected claims 1 - 8, 10, 11, 17 - 22, 25, and 26 under 35 U.S.C. 102(b) as being anticipated by U.S. Patent No. 5,475,211 to Ogura et al.

Applicants have carefully reviewed the cited reference, and submit the cited reference of record, does not teach, nor fairly suggest, the concept of a sensor with micro-spring interconnects integrated into an array of light-emitting sources.

Applicants traverse the Examiner's strained interpretation of the reference as teaching the claims of the present invention. Initially, the Examiner interprets the micro-spring interconnect, of the present invention, as being the equivalent of the "flexible printed board 9."

With specific attention to claim 1, Applicants traverse the Examiner's position that the flexible printed board **9** of Ogura et al., teaches or fairly suggests the micro-spring interconnect. Particularly, the exact language in the rejection is "a micro-spring interconnect '9' formed on the substrate . . .." Clearly, Ogura et al. clearly shows that flexible printed board **9** is not "formed on the substrate." Particularly, as depicted in FIGURE 23A, no flexible printed board **9** is shown. However, in the next process of the construction of the device of FIGURES 23A-23B, board **9** is brought into position or connection with an IC.

Next, the Examiner points to column 10, lines 38-45 as allegedly teaching, "the micro-spring interconnect including, an elastic material." Rather than teaching the Examiner's position, this section clearly teaches a completely unrelated method of making connections. Specifically, this section calls out that the "first circuit connecting part 1a and a flexible printed board 9 are connected with a wire bonding (lines 38 and 39)."

Thus, a "wire bonding" technique is used for connection of parts in the device of Ogura et al., while on the other hand the present invention clearly defines the interconnect as a micro-spring.

Next, the Examiner points to FIG. 23B for showing an "anchor portion fixed to the substrate, and a free portion." Applicants again review FIGURE 23B and find no micro-spring interconnect which has an anchor portion and a free portion. This reference is simply about another connection technique of elements, and has no relationship to the concepts of the present invention.

Lastly, it is argued that the "micro-spring interconnect and said sensor being integrated on the substrate is shown by FIG. 23 B." Again, as alleged in the Office Action, part of the interconnect includes the flexible board **9**, this board is not integrated substrate. There is no integration of the flexible board to the substrate. Rather, the only connections of the flexible board is to the IC. If it is the Examiner's interpretation, that the sealing material **8** (column 10, line 43) is equivalent to the claim language of the micro-spring interconnect and the sensor being integrated on substrate, Applicants respectfully traverse such an interpretation. Particularly as can be seen, a portion of the flexible printed board **9** and IC may be sealed to the board, but they are not integrated to the substrate as claimed, and as supported in the specification of the present application.

For the foregoing reason, independent claim 1 is not taught or fairly suggested by the cited reference. Further, as independent claims 17, 22 and 26 include at least some similar distinguishing features from the cited reference, these claims are also not taught or suggested by Ogura et al.

Again, the Ogura et al. reference is directed to a photoelectric conversion device suitable for a smaller construction and lesser weight, capable of making the width of a photosensor substrate narrower, and to provide an information processing apparatus having the device.

Applicants assert that the Ogura et al. is silent with regards to a light detecting sensor having integrated micro-spring interconnects, incorporated into an array of light-emitting sources, and used is to calibrate the array of light-emitting sources. In the present invention the light detecting sensor monitors the light output of each individual laser element in the array. This sensor then provides a means to calibrate the array of lasers by detecting light from the lasers and subsequently correcting for variances in the lasers of the printbar. The light detecting sensor is integrated into the light-emitting sources. Additionally, this sensor is placed permanently in front of the print bar without disturbing normal print operation.

The sensor readout is performed periodically, and the calibration results are stored in an electronic look-up table. This is then used to determine the appropriate amount of current with which to drive each laser in order to produce the proper light output of the laser. The sensor is fast enough so that the operation does not appreciably reduce the throughput of high speed printers.

Ogura et al. makes mention of a sensor unit using the photoelectric conversion device. The sensor unit of Ogura et al. is comprised of photoelectric conversion devices for converting a scanned image into a digital data stream. (col. 12, lns. 1-5)

Clearly, Ogura et al. does not teach, nor fairly suggest the present invention in which a light detecting sensor having integrated micro-spring interconnects, incorporated into an array of light-emitting sources, and is used to calibrate the array of light-emitting sources. Accordingly, Applicants further respectfully submit that independent claims 1, 17, 22 and 26, of the present patent application are patentably distinct over the cited prior art. Specifically, independent claims 1, 17, 22 and 26, include the limitation of a light detecting sensor having integrated micro-spring interconnects, incorporated into an array of light-emitting sources, and is used to calibrate the array of light-emitting sources, and further being a novel feature of the

present invention. As such, independent claims 1, 17, 22 and 26, and claims depending therefrom are patentably distinct from the cited prior art and that the rejection be withdrawn.

Applicants submit that independent claims 1, 22 and 26, have been amended to improve the readability of the claims. However, the amendments being made to the claims are not limiting amendments.

Further, in independent claims 1, 17, and 26, the Examiner considered that the phrase "the sensor including an active layer and contacts" is structure inherent. Applicants are not sure they fully understand the Examiner's position. However, from its interpretation, Applicants must disagree that this is "structure inherent." Particularly, every sensor does not need to have an active layer and contacts. Sensors do exist which are designed without contacts, such as an RF sensor. Further, a sensor does not need to be active, *i.e.*, it might be a passive, and therefore no active layer would exist.

As such, Applicants submit that the phrase "the sensor including an active layer and contacts", is not "structure inherent." Applicants assert that the phrase, as used in the claims is proper and distinctly defines properties of the present invention.

The 35 U.S.C. 103(a) Dependent Claims Rejections

The Examiner rejected claims 9, 12, and 13 under 35 U.S.C. 103(a) as being unpatentable over Ogura et al. in view of Yamazaki et al.

Further, dependent claims 14 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ogura et al. in view of Sekiguchi.

Additionally, dependent claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ogura et al. in view of Yamada et al.

Finally, dependent claims 23 and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ogura et al. in view of Rajeswaran.

Applicants have carefully reviewed the cited references of record. Applicants submit that the cited references, do not teach, nor fairly suggest, either singly or in combination, the concept of a light detecting sensor having integrated micro-spring interconnects, incorporated into an array of light-emitting sources, and is used to calibrate the array of light-emitting sources.

Applicants assert that independent claims 1, 17, 22, and 26, and claims 9, 12, 13, 14, 15, 16, 23, and 24 depending therefrom are patentably distinct over the cited prior art references.

Specifically, Applicants assert that the cited references are silent with regards to a light detecting sensor having integrated micro-spring interconnects, incorporated into an array of light-emitting sources, and used to calibrate the array of light-emitting sources. In the present invention the light detecting sensor monitors the light output of each individual laser element in the array. This sensor then provides a means to calibrate the array of lasers by detecting light from the lasers and subsequently correcting for variances in the laser output of the printbar lasers. Additionally, this sensor is placed permanently in front of the print bar without disturbing normal print operation.

The sensor readout is performed periodically, and the calibration results are stored in an electronic look-up table. This is then used to determine the appropriate amount of current with which to drive each laser in order to produce the proper light output of the laser. The sensor is fast enough so that the operation does not appreciably reduce the throughput of high speed printers.

While Ogura et al. makes mention of a sensor unit using the photoelectric conversion device. This sensor unit of Ogura et al. is comprised of photoelectric conversion devices for converting a scanned image into a digital data stream. (col. 12, lns. 1-5) Ogura et al. is clearly silent in regards to monitoring a laser light source by using a light detecting sensor having integrated micro-spring interconnects, incorporated into

an array of light-emitting sources, and used to calibrate the array of light-emitting sources.

Clearly, the cited references of record do not teach, nor fairly suggest the present invention, either singly or in combination, a light detecting sensor having integrated micro-spring interconnects, incorporated into an array of light-emitting sources, and is used to calibrate the array of light-emitting sources. Accordingly, Applicants respectfully submit that independent claims 1, 17, 22 and 26, of the present patent application, and claims 9, 12, 13, 14, 15, 16, 23, and 24 depending therefrom, are patentably distinct over the cited prior art. Specifically, independent claims 1, 17, 22 and 26, include the novel limitation of, a light detecting sensor having integrated micro-spring interconnects, incorporated into an array of light-emitting sources, and used to calibrate the array of light-emitting sources. Accordingly, independent claims 1, 17, 22 and 26, and claims 9, 12, 13, 14, 15, 16, 23, and 24 depending therefrom, are patentably distinct over the cited prior art references, and that the rejection be withdrawn.

The 35 U.S.C. 103(a) Rejections

Claims 1, 17, 22, and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tanaka et al. in view of U.S. Pat. No. 5,613,861 to Smith et al.

Applicants have carefully reviewed the cited references. Applicants submit that the cited references of record, do not teach, nor fairly suggest, either singly or in combination, the concept of a light detecting sensor having integrated micro-spring interconnects, incorporated into an array of light-emitting sources, and is used to calibrate the array of light-emitting sources.

Applicants traverse the Examiners strained interpretation that the primary reference discloses the present invention of a hybrid device, except for the micro-spring interconnect. Applicants assert that the Tanaka et al. reference is silent in

regards to a light detecting sensor having integrated micro-spring interconnects, incorporated into an array of light-emitting sources, and is used to calibrate the array of light-emitting sources.

Applicants assert that the Tanaka et al. reference is silent with regards to a light detecting sensor having integrated micro-spring interconnects, incorporated into an array of light-emitting sources, and is used to calibrate the array of light-emitting sources. In the present invention the light detecting sensor monitors the light output of each individual laser element in the array. This sensor then provides a means to calibrate the array of lasers by detecting light from the lasers and subsequently correcting for variances in the laser output of the printbar lasers. The light detecting sensor is therefore used to monitor and calibrate the array of light-emitting sources. Additionally, this sensor is placed permanently in front of the print bar without disturbing normal print operation.

The sensor readout is performed periodically, and the calibration results are stored in an electronic look-up table. This is then used to determine the appropriate amount of current with which to drive each laser in order to produce the proper light output of the laser. The sensor is fast enough so that the operation does not appreciably reduce the throughput of high speed printers.

Clearly, the references of Tanaka et al. and Smith et al, does not teach, nor fairly suggest the present invention, either singly or in combination, in which a light detecting sensor having integrated micro-spring interconnects, incorporated into an array of light-emitting sources, and used to calibrate the array of light-emitting sources. Accordingly, Applicants respectfully submit that independent claims 1, 17, 22 and 26, of the present patent application are patentably distinct over the cited prior art. Specifically, independent claims 1, 17, 22 and 26 recite a light detecting sensor having integrated micro-spring interconnects, incorporated into an array of light-emitting sources, and is used to calibrate the array of light-emitting

sources. As such, independent claims 1, 17, 22 and 26, and claims depending therefrom are patentably distinct from the cited prior art references and that the rejection be withdrawn.

Applicants submit that the amendments to independent claims 1, 17, 22 and 26, and related dependent claims have been made for reasons not related to patentability and have not narrowed the scope of the claims amended to more properly recite a positive limitation.

Further, in independent claims 1, 17, and 26, the Examiner considered that the phrase "the sensor including an active layer and contacts" is structure inherent. Applicants disagree that this is "structure inherent", because a sensor can not have an active layer and contacts, until it is fabricated using a photolithographic process, and is not a complete device, until all the steps in the process have been completed. Applicants express difficulty in determining how a blank amorphous silicon die can have inherent structures of a sensor, or a transistor, for example, until the photolithographically processes is complete.

Accordingly, it is respectfully submitted that amended independent claims 1, 17, 22 and 26, and claims depending therefrom are patentably distinct from the cited prior art references, and that the rejection be withdrawn.

CONCLUSION

In view of the foregoing, it is respectfully submitted that amended independent claims 1, 17, 22 and 26, and claims depending therefrom are patentably distinct from the cited prior art references. As such, the present patent application is now in condition for allowance. An early notice to that effect is therefore earnestly solicited.

Respectfully submitted,

FAY, SHARPE, FAGAN,
MINNICH & McKEE, LLP

Mark S. Svat
Reg. No. 34,261
1100 Superior Avenue 7th Floor
Cleveland, Ohio 44114-2518
(216) 861-5582

N:\XER\20292\US\KMF0313A.WPD

VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE SPECIFICATION

Please substitute the following paragraph as amended for the third full paragraph on page 3:

Provided is a hybrid structure or device integrated in a substrate, where in some cases the substrate is substantially transparent to light at infrared wavelengths. Integrated on the substrate are a plurality of micro-spring interconnects, where the micro-spring interconnects are formed of an elastic material that is initially fixed to a surface on the substrate. Upon release of a sacrificial layer a free portion moves out of the plane of the substrate in a self-assembling manner. A sensor is formed on the same substrate, and includes an active layer and contacts. The active layer may be substantially transparent to light at infrared wavelengths. The micro-spring interconnects and the sensor are integrated on the substrate and configured using a compatible manufacturing process.

Please substitute the following paragraph as amended for the first full paragraph on page 6:

Spring contacts **20** and **22** are photolithographically patterned on substrate **18** and designed for electrical connections between devices. An inherent stress gradient in each spring contact causes free portions of the spring contacts to bend up and away from the substrate when a sacrificial layer is selectively removed. An anchor portion remains fixed to the substrate. The spring contact is made of an elastic material and the free portions, which are initially fixed, before the sacrificial layer is selectively removed from the substrate, provides for compliant contacts between devices for an electrical interconnection.

Please substitute the following paragraph as amended for the fourth full paragraph on page 8:

Turning to stage 2, illustrated by FIGURES 5b and 6b, a hydrogenated amorphous silicon sensor (a-Si:H) component or active layer **44** is grown on top of the first transparent/conductive layer **42**[.]. a-Si:H sensor component **44** is usually comprised of three layers. The first layer **44a**, is a n^+-doped layer of material, typically less than 1,000 angstroms in thickness. Though not limited thereto, the first layer **44a** may be a n^+ phosphorous-doped amorphous silicon, or n^+ arsenic-doped silicon. A second layer **44b** is intrinsic amorphous silicon, of a thickness less than a micron, preferably in the range of 3,000-5,000 angstroms. The third layer **44c** of sensor element **44** is a p^+-doped amorphous silicon of approximately 100 angstroms thickness. An example of a p^+-doped amorphous silicon which may be used as third layer **44c** is p^+ boron-doped amorphous silicon.

IN THE CLAIMS

Please amend Claim 1 as follows:

1. (Amended) A hybrid device comprising:

a substrate;

a micro-spring interconnect formed on the substrate, the micro-spring interconnect including,

an elastic material that is initially fixed to a surface on the substrate including,

an anchor portion fixed to the substrate, and

a free portion; and

a sensor formed on the substrate, the sensor including an active layer and contacts, said active layer [being capable of] sensing light,

said micro-spring interconnect and said sensor being integrated on the substrate.

Please amend claim 11 as follows:

11. (Amended) The invention according to claim 10 wherein the elastic material is a stressed metal layer having sub-layers

of differing stress gradients, [whereby] wherein when the sacrificial layer is released from the passivation/release layer, the released portion moves out of a plane of the substrate.

Please amend claim 13 as follows:

13. (Amended) The invention according to claim 9, wherein the active layer is a three layer element, wherein a first layer is a n+-doped amorphous silicon, the first layer being one of, but not limited to n+ phosphorous-doped amorphous silicon and n+ arsenic-doped silicon;

wherein a second layer is an intrinsic amorphous silicon;

wherein a third layer is a p+-doped amorphous silicon, the third layer being, but not limited to, p+ boron-doped amorphous silicon.

Please amend claim 22 as follows:

22. (Amended) A calibration/printing system comprising:

a sensor configuration including a sensor element integrated on a substrate with a plurality of micro-spring interconnects;

a light source aligned with the sensor configuration such that at least a portion of the light from the light source is sensed by the sensor and at least a first of the micro-spring interconnects is in physical contact with a portion of the light source;

a driver chip aligned with the sensor configuration and the light source such that at least a second of the micro-spring interconnects is in physical contact with a portion of the driver chip, [whereby] and a communication path is formed between the light source and the driver chip by the at least first and second micro-spring interconnects.

Please amend claim 23 as follows:

23. (Amended) The invention according to claim 22 wherein the driver chip further includes:

a comparator for comparing a sensor readout current

from the sensor and a reference current;

a converter arrangement which converts the output of the comparator into digital data representing characteristics of the light source;

a set of low frequency shift registers configured to receive and store the digital data;

an activation signal selectively supplied to the light source to selectively emit light therefrom;

a driver designed to interpret the digital data as activation signal correction information for the activation signal;

a high frequency shift-register configured to receive and store digital image data from a source external to the driver chip; and

an enable/disable output from the high frequency shift-register to selectively supply the activation signal and light source correction information to the light source, [whereby] wherein an amount of light emitted by the light source is controlled.

Please amend claim 26 as follows:

26. (Amended) A hybrid device comprising:

a micro-spring interconnect structure; and

at least two devices electrically connected by the interconnect structure wherein,

one of the devices is a sensor, the sensor including an active layer and contacts, said active layer [being capable of] sensing light, and

another one of the devices is at least one of a single light source, an array of lasers, and an array of light emitting diodes (LEDs), positioned to emit light at least partially through the sensor.